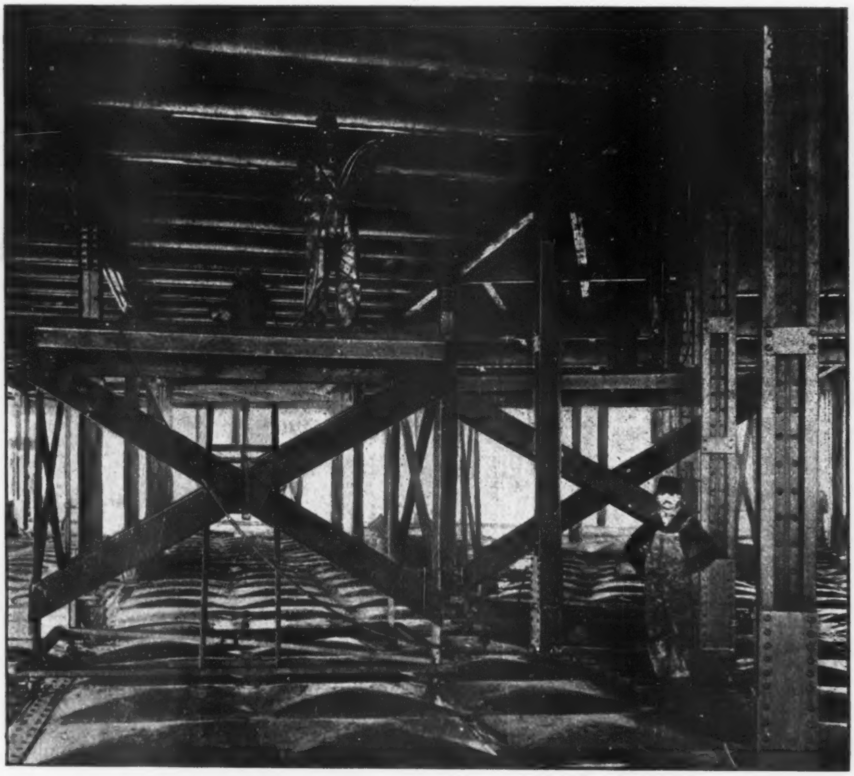
Compressed Air

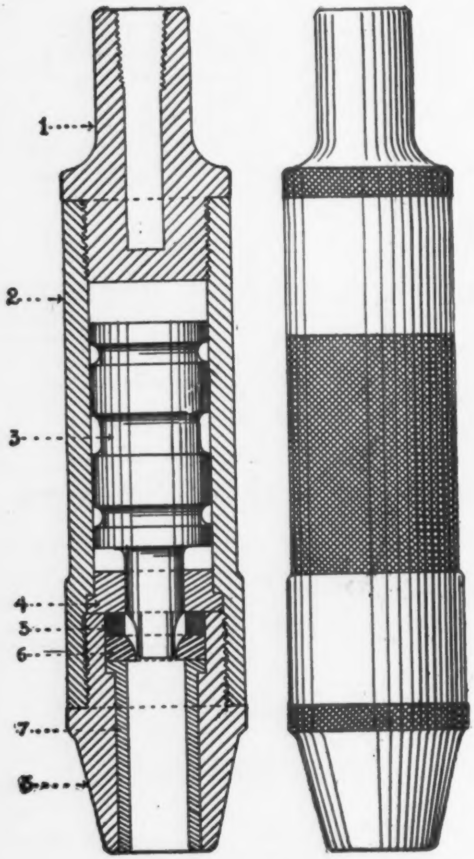
DEVOTED TO THE USEFUL APPLICATION OF COMPRESSED AIR.

VOL. II. NEW YORK, APRIL, 1897. No. 2



PAINTING STRUCTURAL IRON WORK BY COMPRESSED AIR.
PHOTOGRAPH TAKEN AT THE U. S. APPRAISER'S STORES, NEW YORK CITY.

Keller Pneumatic Stone and Metal Cutting Tool!



Parts

1. *Inlet piece*
2. *Cylinder*
3. *Hammer*
4. *Hammer Washer*
5. *Leather Washer*
6. *Tool Washer*
7. *Steel bushing*
8. *Nose*

Absolutely Valveless.

Patented November 12, 1895.
" May 26, 1896.

Furnished subject to ten days trial.

These Tools have always been preferred when comparative tests with other tools have been made.

Write for Circular and List of Parties Using this Tool.

MANUFACTURED BY

C. H. HAESELER CO.,

1026-1030 Hamilton Street, - - - Philadelphia, Pa.

"Phoenix" Pneumatic Drills, Reamers and Tappers, Breast Drills, Hoists, Compressors, Sand Sifters and Motors.

Everything in the line of Pneumatic Equipment.

Compressed Air.

A MONTHLY PUBLICATION DEVOTED TO THE USEFUL APPLICATION OF COMPRESSED AIR.

W. L. SAUNDERS, - - Editor and Publisher
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Subscription, including postage, United States, Canada and Mexico $1.00 a year. All other countries, $1.50 a year. Single copies, 10 cents.

Advertising rates furnished on application.

We invite correspondence from engineers, contractors, inventors and others interested in compressed air.

All communications should be addressed to COMPRESSED AIR, 26 Cortlandt St., New York.

London Office, 114a Queen Victoria Street.

Those who fail to receive papers promptly will please notify us at once.

Entered as Second-Class Matter at the New York, N. Y., Post Office.

VOL. II. APRIL, 1897. NO. 2.

A compressed air motor for propelling a tricycle is an invention which the Hartley Power Supply Co., Chicago, has just put on the market. It is of novel construction and unlike anything used up to the present time for motocycle propulsion. Its first commercial use will be for collecting and delivering mail in suburban districts of Chicago.

In construction it is similar to the ordinary tricycle. Under the handle bars is the compressed air bottle or tank, and between the handle bars and the seat is the lever with which the motor is worked.

The mail pouch is placed between the two front wheels, and is easily reached by the rider from his seat. It is provided with pneumatic tires, and is able to move at almost any reasonable rate of speed.

The U. S. Government has experimented successfully with compressed air for fog signals along the coast. A recent installation at Montauk Point, L. I., consists of one Ingersoll-Sergeant air compressor, one Hornsby-Akroyd oil engine, and trumpets for sounding. The air is delivered at 50 lbs. pressure, and exhausted at 30 lbs. The noise made is deafening but satisfactory.

The *Engineering News* says: "It begins to look as if the compressed air nozzle was to become the most used tool in the painter's trade. We publish on another page a summary of some recent expressions on the subject of painting freight cars by compressed air which are practically unanimous in favor of that method. The painter's trade is an exceedingly conservative one, and it is safe to say that if the new method had not shown a very material saving in the total cost over the old system of application of paint by hand brushes, it would never have been adopted so extensively in this field in such a short time."

A recent improvement in reheaters has been applied on the Jerome Park Reservoir work, New York city.

Small reheaters have been attached to the hoisting engines, each heater taking care of one engine only. These heaters are about the size of a beer keg, light and portable, the grates are eight inches in diameter, and the heat is supplied by sticks of wood thrown in at the top, one armfull lasting a whole day. In one case the exhaust of the engine runs into the stack of the heater, and in this way the fires are easily kept burning, a short smokestack only being necessary. Temperature records are not yet available, but a recent examination of one of these heaters during rapid work of the hoist showed to the touch of the hand considerable increase of temperature in the discharge pipe.

Several subscribers write for back numbers of COMPRESSED AIR.

To supply these friends of ours, we will pay twenty-five cents a copy for a limited number of the following issues: June, 1896; July, 1896.

PAINTING BY COMPRESSED AIR.

IMPORTANT DISCUSSION BY THE NEW ENGLAND RAILROAD CLUB.

At the February meeting of the New England Railroad Club the subject for discussion was: "Is it Economy to use Compressed Air in Painting Railway Equipment? The facts presented by the various speakers are of such a character that they have been widely published aud favorable comment has been the rule. We reproduce the various interesting parts of the discussion. Following are the remarks of Mr. C. E. Copp, general foreman painter B. & M. R.R.:

"I saw and questioned a man who painted the equivalent of 29 standard 34-ft. coal cars in about five hours, which is an average of one every 10 minutes, and the air pressure was poor. Various speeds of from five to ten minutes per car were realized at this work. This was for the car body and attachments only. No more material was wasted than by the brush generally. By a test made at the Pittsburg & Lake Erie shops less was used by the spray method. But when computing the expense of painting by compressed air, the cost of the air should be reckoned in. Westinghouse air pumps will not answer for all these attachments that are being put on the shops; there must be compressors of more power employed.

As to the practicability of this method, conditions will vary. As an open-air way of painting cars in yards in pleasant weather, I have no doubt of its utility, by having the yards, of course, piped with the air, with connections at proper intervals. But in very cold weather out of doors it is found that the condensation or dampness of the air in the hose congeals and stops the valves, rendering them inoperative. To remedy this trouble, some way of warming the air by passing it through a heated coil has been considered. My opinion is that it will require as much skill, if not more, to operate a spray successfully as by the brush method, especially if the machine is at all complicated. And then it must be adjusted rightly, held at the proper distance from the work, and not too long in one place; for, if it is, it will produce unsightly runs, requiring slicking up with a brush afterward.

If lead dust from sandpapering is deadly to breathe into the system, what may lead mist be from spraying? And so green paint containing arsenic, or any other poison. But if cars are painted with an earth paint, as they should be, such as mineral brown, which most roads are doing, then no fears need be entertained of its poisonous effects. And in this connection I should recommend, if this method of painting were adopted, to do the car all over with it, top, body, trucks, iron-work and all, and afterward black no irons, as they would be much more durable that way than with the asphaltum black which is generally applied.

As to the quality of work done by the spray method in comparison with brush work, it may be thought that the working of a heavy-bodied paint well into the pores of the wood by a patient and diligent spreading of the same by hand with a brush would be more durable than the sprayed article, and doubtless it would be if it were done; but, as a matter of fact, freight cars are not painted that way in nine case out of ten. We know that they are slopped over in the most hap-hazard way possible, especially at piece-work prices, the only object being to cover them with the paint and a brush, which is often of huge proportions, so that the paint runs down the beads and drips on the floor.

To the credit of paint sprayed on, it may be truthfully said that it will go into places where, with great difficulty, if not impossibility, it is to be put with a brush.

Regarding the immediate adoption of this method of work, I should recommend its postponement, except in the line of experiment, until its patentability is cleared up, and then only when its practicability was fully settled."

Mr. Worrall presented the following, which was prepared by Mr. W. O. Quest, foreman of painting, P. & L. E. R.R. Co. :

"We will further call your attention to the fact that a perfectly atomized sprayed on paint will almost instantaneously reach, cover up and consequently protect a car's most complicated structural parts. It penetrates the rough beaded work—the open joints through shrinkage of sheathing—the crevices and other disfigurements usually met with where painting the new and repainting the old railway freight car equipment. In refutation to existing doubts in circulation, we will ask you to accept the evidence of the close observation made by us, from time to time, of some sprayed freight and other large surface work done by the P. & L. E. R.R Co., in the beginning, convincing us that the results from a standpoint of durability will not suffer on the score of fact that the paint was not applied with a brush.

We will also advance the theory that we will be safe when we express the belief that the operation of a perfect atomized painting apparatus will not injure the health of the operator, if the proper precautionary measures are taken. The safeguard we would suggest against this possibility is to use nothing but a perfect atomizing device, which should be worked to its full capacity with a sufficient generated air pressure to force the paint clear of nozzle on to work without dripping. The much-objected-to white spray, which is always perceptible during the spraying operation, on investigation will prove to be nothing worse than volumes of discharged surplus air, which becomes vaporous on forced release, from the fact of air being so much lighter than the heavier atoms of paint which is ejected with great force ahead on to the work, and not back, as it has been claimed, into the face of the operator.

This being the fact, we would judge there need be no danger apprehended in a health sense, through the practical use of the pneumatic paint sprayer, where properly operated. Deeming the above summary a sufficient introductory for the paint spraying issue, we will now proceed to take up the question of comparative cost of paint used, the utility of innovation, etc.

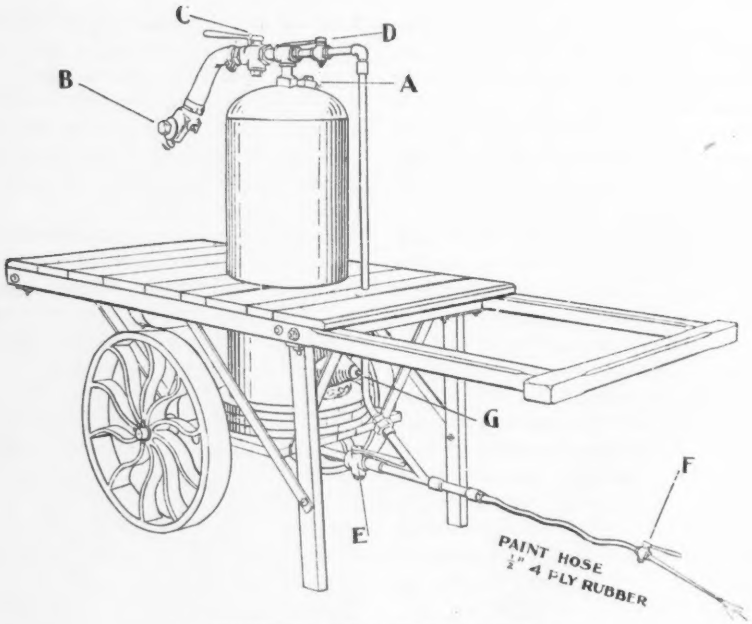
The following is the estimated cost of the work done in the Pittsburg & Lake Erie Company's freight yard during the period in which the spraying apparatus was in operation. This is compared with the time and cost of work done with the brush the laborers are paid on the piece-work plan:"

	Piece Work.		With Spray.		Saving, per cent.
	Hours.	Cost.	Hours.	Cost.	
Box	3½	.60	3¼	.15	75
Coal	1½	.30	¼	.10	66 2-3
Coke	3	.50	½	.12	76
Flat	½	.10	1-6	.05	50
Trucks, all cars	......	.30	......	.12	60
Roof only, box	....	.10	......	.04	60

The following is taken from a paper prepared by Mr. H. G. McMasters, master car painter, Illinois Central R.R. :

"It takes from two to three hours, or we will be liberal and say two hours, to coat a 35-ft. box car with the brush. Now, we feel safe in making the assertion that a man who has never seen a spraying machine before can take one and coat a car in at least one hour at his first attempt, which, even at that rate, is a saving of one hour per coat, and this will be increased as the workman becomes accustomed to the machine.

So far with the sprayer we have been unable to show a very great saving in paint over the brush, but even if we do not make a saving in paint, and use the same amount we did with the brush, the saving in labor will pay us to use it, as the following figures (which we had occasion to take a few days ago) will show :



COMPRESSED AIR PAINTING MACHINE.

PRIMING NEW 35-FT. BOX CAR BY HAND.

Labor, 2 hours, at 20c	$ 40	
Material, 14 lbs. paint, at 5c	70	
Total		$1 10

PRIMING NEW 35-FT. BOX CAR WITH SPRAYING MACHINE.

Labor, 35 minutes, at 20c. per hour	$ 12	
Material, 12 lbs., at 5c	60	
Total		72
Total saving of		38

Or 34.57 per cent.

Saving of labor painting by spraying machine, 28c., or 70.83 per cent.

Saving of material, painting by spraying machine, 10c., or 14.29 per cent.

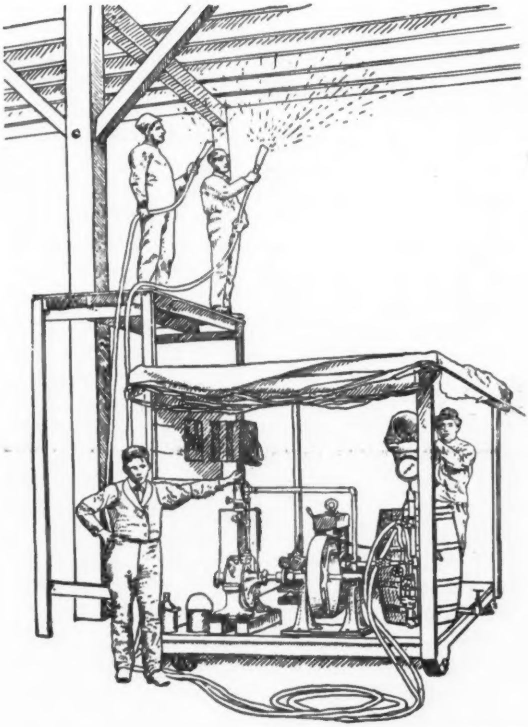
Roof and trucks not included.

The above figures include placing staging around the car, making all air connections, filling and cleaning machine, replacing hose, etc., or the actual cost of priming one car.

The cost of second and third coating vary slightly, but are materially the same as above. We also find it profitable to use the sprayer on a number of things in the coach shop, but, as we said before, a little experimenting with one will show how really profitable it is."

The Appraiser's Stores Bldg., Painted by Air.

At the present time the iron works of the U. S. Appraiser's Stores, foot of Christopher street, New York city, is being painted by compressed air. It is a ten story building, covering an entire block. The painting is being done by the contractors, Post & McCord. Four painting machines, made by the Turner Machine Co., are being used. The whole outfit



APPARATUS USED FOR PAINTING THE WORLD'S FAIR BUILDINGS.

comprises one Clayton Compressor and four spraying machines. In operation it requires one man for each spray, and to facilitate the work three additional men are employed to carry paint, move travelers and be in attendance for whatever purpose may be required of them. One man with a spraying machine can paint as much in 4 minutes as can be done by hand in 45 minntes. The paint used is ordinary red lead and oil.

The average work of four men, each with a machine, has been 100,000 square feet in 5 days, working 8 hours each day. Mr. John C. McCord is superintendent of the work. The compressor is located on the fourth floor, and 40 lbs. pressure is carried. The machines work under 15 lbs. pressure, and do the work thoroughly.

The incidents leading up to the painting of the Appraiser's stores are of interest in the way of the development of painting by air. The machine was perfected by Mr. C. Y. Turner, who was assistant decorator under Mr. F. D. Millett at the World's Fair in 1892. The work of painting the buildings was done by a rotary machine, and the material used was kalsomine. It was accomplished with great success. So rapidly was the work done that the inside of the great Manufacturers' Building, which covered 31 acres of ground, was

done in one month. The largest amount of surface covered in an eight-hour day was 31,500 feet by one double spray outfit. Since that time a number of outfits have been furnished to manufacturers and others for painting and whitewashing, and the machine of to-day is much advanced from the style used at the World's Fair.

It was necessary to facilitate the painting of the structural iron of the Appraiser's stores. The machines mentioned were put in for a trial test by the Turner Machine Co. Red lead was used, and it was distributed in a most satisfactory manner, and the machines were adopted. The machines in use by the various railroad shops are adaptations of the original Turner machine.

Paint for Pneumatic Spraying.

Some inquiry having been made as to the requisite nature of paint to be successfully sprayed, we will say that any paste paint thinned down with oil to the proper consistency to be applied with a brush, can be handled with the spray, with sufficient force. It is not customary, however, to use a paint for this purpose (usually oxide of iron mineral) that weighs over ten pounds per gallon. If a semi-paste is used mix 3 parts Sipe's Japan oil with 1 part raw linseed oil thoroughly. Of this mixture take 7 lbs. and mix 3 lbs. of finely ground metallic paste paint, which makes a spraying paint that weighs 10 pounds per gallon. In an experiment of painting a gondola coal car recently we took the Patterson-Sargent Co.'s liquid mineral roof paint, which is a very heavy paint—too heavy for brush, without thinning, and weighs 17 to 18 pounds per gallon,—and thinned it down with Sipe's Japan oil to about 11 pounds per gallon, and it worked successfully; but a little greater air pressure and a pound lighter paint per gallon would have produced better results. Sipe's Japan oil, being light-bodied and a good drier, is, with linseed, well adapted for this purpose.—*R. R. Car Journal.*

COMMUNICATIONS.

Under this heading will be published inquiries addressed to the Editor of COMPRESSED AIR. We wish to encourage our readers in the practice of making inquiries and expressing opinions.

We request that the rules governing such correspondence will be observed, viz: all communications should be written on one side of the paper only: they should be short and to the point.

Editor COMPRESSED AIR:

DEAR SIR,—Knocking about the mines where compressed air is being used, I hear a good deal said about the deleterious effect of compressed air upon the health; only recently one foreman going so far as to say that compressed air was very bad to breathe, as the result of compression gave a quality of air very different from that of the atmosphere. He went on to say that a *chemical change* took place in the air as the result of compression.

Upon investigation, I found that they were using a very inferior quality of oil, and, running the compressor very hot, the result naturally followed that a certain amount of gas from the decomposition of the oil found its way into the headings, and naturally affected the men.

It might be wise, therefore, that this matter should be discussed a bit in your admirable publication, and thoroughly explained to the uninitiated. There seems to be a belief among miners that compressed air is a bad thing to breathe, or rather that the exhaust from drills in some way affects the health of the miner.

Am I not right in my surmise that it is simply the use of a poor quality of oil in the compressor?

Yours very truly,

BENJ. B. LAWRENCE,

Mining Engineer.

Denver, Col., March 13, 1897.

[In compressing air for the ordinary purposes of mining, temperatures between 200 and 400 degrees are obtained in the air cylinder, notwithstanding the cooling jackets. This tends to volatilize the oil, carrying gases into the mine with the air. A

high grade oil will be comparatively free from objection in this respect, but in no case is it likely that a chemical change takes place in the air, or that there is anything unhealthy about it. Many of the germs or organisms which exist in free air are destroyed by the heat of compression. A process has been recently introduced for the preservation of fruits and meats by confining them in dry air which had previously been compressed and dried, the purpose of compression being mainly to kill the germs. Compound compression or compression in stages aids in preventing the smell from oil. This is natural, because in compound compression the heat does not reach as high a point as in single stage compression.—ED.]

The effect upon men working in a confined space where pure air is continually being exhausted, should have a tendency to make a model workman out of the laziest man.

There is no reason to believe that heat (even intense heat) should cause a chemical change in the two gases composing the mechanical mixture, air. The heat of compression in the average compressor does not rise much above 350 deg. F.; and if any foreign substance is present, such as oil (in excess often), there will be a tendency for it to volatilize at that temperature unless the *quality* is such that the 350 deg. F. will have no volatilizing effect upon it.

It is only necessary to refer to the use of compressed air in caissons to prove that the air undergoes no chemical change by virtue of the heat of compression. The only difficulty met with there is on account of the effect of the pressure on the human body; the extra amount of oxygen present in a caisson has the most exhilarating effect upon the workmen. F. C. W.

Referring to the deleterious effect of compressed air on human life, I asked Professor Hart, the chemist, if air underwent any change in compressing and heating, and he said not, and that if there was any odor in compressed air it was caused by the oil. This was what I supposed to be the case. From my own experience I must admit that there is an odor to compressed air which it undoubtedly receives partly by some of the oil becoming volatilized owing to using poor oil, and where excessive heat is in the air due to poor cooling, but mostly by the air passing through the receiver and pipe line which are more or less coated with oil—the air, even when cold, being able to take up odors. A good example of this would be the delightful odor one meets when passing through a pine forest. It does not follow that air in which an odor is perceptible is unhealthy, for in the case of a pine forest the odor is both agreeable and healthy, while with many antiseptics the odor is disagreeable, but still healthy. I do not think compressed air any exception to the rule, for the slight odor it has is not disagreeable, and as the air was pure when it entered the compressor and had nothing to mix with except the small amount of oil that was fed to the air cylinder for lubrication, this only amounting to about one pint of oil for every 1,000,000 cu. ft. of free air, or such a small percentage that the air itself should not be appreciably changed.

Wherever the odor of compressed air becomes objectionable, it must be due to the air being excessively hot and poor oil used, that the oil is turned into a gas which mixes with the air, and also that a great excess of oil is used; but even with the most unfavorable conditions, the percentage of oil would be so small that the large amonnt of air with which it was mixed should have no deleterious effect on the life of people who were inhaling same. With good oil, of which only a small quantity is necessary, a good compressor with good cooling, no oil should ever be turned into a gas. W. P.

Sand Blast Method.

SAID TO BE THE BEST FOR CLEANING SHIPS.

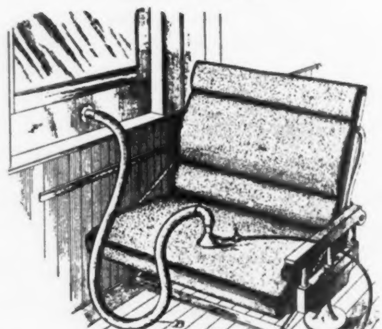
The test of the new sandblast method for cleaning the hulls of ships, made at the Navy Yard last week, will in all probability be followed by the introduction of the system into the different naval stations of the United States. The experimental tests on the bottom of the cruiser Atlanta, fully demonstrated the advantages of the new system over the method of doing the work by hand, now prevalent in the various navy yards. Not only does the sandblast system remove all foreign matter from the hulls in much less time than it takes to do the same work by the present system, but it is also cheaper. Naval officers who investigated the tests of the sandblast method made at the yard, have ezpressed themselves as greatly pleased with it and it is expected that the officials will recommend its adoption to the navy department.

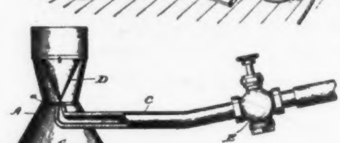
The method is not a new idea, having been in operation for some years in nearly all the large dock yards and naval stations of Great Britain. The system has been most successful there. The machinery needed is simple and comparatively inexpensive, comprising a pneumatic air pump, which forces the compressed air through a hose. An arrangement is attached to the end of the hose by which fine sand is played into it. As the air is turned on the sand is played on the ship's bottom by the operator, who directs the stream to the points where cleansing is needed.

The compressed air pump is of the simplest character, and furnishes a pressure of only fifteen pounds to the square inch. This is powerful enough, however, to drive away all foreign matter from the steel plates of the ship's bottom in a remarkably short space of time, and it leaves the steel plates polished and as smooth as if they had been rubbed with emory paper. Paint, rust, scales and barnacles dissappear as if by magic under the blast of the sand from the hose, and the inventors of the new method claim that it is five times as quick as the old hand method of cleaning a ship's hull. During the tests of the sand blast on the cruiser Atlanta, which was in dry-dock undergoing repairs, a space of ten feet square was thoroughly cleaned and polished smoothly in a few minutes. Hard paint, nearly one-eighth inch thick, was taken off with ease.

Naval Constructor F. W. Bowles, Captain of the Yard, Higginson, and Equipment Officer, Captain Sperry, were present when the experimental tests were made, and all three officers expressed themselves as greatly pleased with the result of the trials. Naval Constructor Bowles was especially impressed with the showing made by the sandblast method and commended its efficiency for cleaning steel plates. An effort will be made by the proprietors of the sandblast to introduce their apparatus into the naval service.

Dust Extractor.





This device comprises the casing A, inverted cone D, discharge pipe B, and air inlet pipe C, arranged as shown in the illustration, combined with the board F, having the discharging end of the pipe B fitted in an opening therein. Invention assigned to the Chicago Pneumatic Tool Co., Chicago, Ill.—*R. R. Car Journal.*

Proposed Extension of the Use of Compressed Air on Men-of-War.

BY F. W. BARTLETT; P. A. ENGR., U. S. N.

Compressed air is now used for certain purposes on men-of-war, as, for charging torpedoes; in combination with water for elevating guns and running them out; for turning turrets; for steering engines, and for ash hoists.

It seems possible and feasible to extend this use, and the object of this article is to suggest some other ways of using air and to state why air is better for many purposes than either steam or electricity.

Air of various degrees of compression may be used for nearly all purposes on board ship, except for the main engines and possibly the dynamos. It could be used for running the dynamos as well, and it is only a question with these whether the economic loss would be balanced by the gains in efficiency, comfort, etc.

It is to be borne well in mind that one of the most serious troubles to be contended with on board men-of-war of modern types is the suffering due to heat and lack of proper ventilation, the debilitation and discomforts in summer, being excessive in cool latitudes and overpowering in hot ones.

An attempt will be made to describe a theoretical arrangement showing the proposed changes, using air in place of steam where possible, economy being perhaps sacrificed for the sake of making life bearable in hot weather on men-of-war, and in order to have the officers and crew in condition to put forth their best efforts when called upon in emergencies.

THEORETICAL ARRANGEMENT FOR THE USE OF AIR MORE EXTENSIVELY.

As near the middle of the length of the ship as possible, preferably between sets of boilers, so that the most direct and shortest steam pipe may lead to the plant, no matter which boiler may be in use, there is an auxiliary plant room, where is located every auxiliary machine in the ship that can be placed there, so that a machinist and oiler on watch may be able to take care of them all, and not have six or eight men on watch in detached parts of the ship. Here are placed the two auxiliary condensers, three evaporators, and distillers, heating and ventilating machine, fire-room blowers, ice machine, dynamos, duplicate air compressors and reservoirs for the pressures required, as described later. These are all operated by steam for the sake of economy, as they all run with constancy when once started.

Besides the steam pipes for the main engines and this short auxiliary pipe for the central plant, the only steam pipes in the ship are those very small ones leading to the galley and pantries. This lessens materially the trouble due to heat, it being confined to a small portion of the length of the ship in port, and to only about a third at sea. The exhaust pipes are all in the central plant room and are short, the auxiliary condensers being close at hand. Thus the heat from this pipe is also in one compartment only. Another important gain here is in the fact that there is at all times a high vacuum in the condensers, all the leakages being in this one room and easily cared for, instead of there being many detached steam-using machines all over the ship, run by all sorts of persons, many of them not knowing enough to close exhaust valves and drains when through runniug a machine, and others not caring to take the trouble even if they know enough.

Aside from the traps for the main engines, there are only six traps in the ship—one from each evaporator, one for the auxiliary steam pipe, one from the galley pipe and one from the pantry pipe. All of these six traps are in the central plant room, and are accessible and readily kept in good order. The discharges from these traps all go into the auxiliary exhaust pipe, as the loss of heat is small,

and not important, compared with keeping the ship bearable in hot weather. This prevents also the constant discharge of vapor from the escape pipe. The discharge pipes from the traps for the main engines are led into the main feed tanks in the engine rooms, and all the pipes lead to near the bottom of the tanks, so that as much of the vapor as possible may be condensed. It was not considered advisable to lead the drains from the main engine traps to the auxiliary exhaust pipe in the distant central plant room, as too much heat would be disseminated on the way.

The discharges from the auxiliary condensers lead to a tank in the same room, this tank being connected with the main feed tanks by a pipe, the water flowing by gravity, from the higher tank in the central plant room, a non-return valve preventing vapor from returning from the main tanks.

Thus the steam used in the ship, and the consequent heating, is only for the main engines and the central plant room, and the functions of the steam are reduced to a minimum, as far as the number of machines operated is concerned.

Of course the air compressors are of considerable power and the pressure accumulators large, to allow for emergencies. These latter, however, occupy the upper part of the room, and are as concentrated as possible. The room is kept cool by its special ventilation, so that the temperature of the air in the accumulators is never much over that of the water outside of the ship, which is used in cooling the air. The specially designed pressure regulators for the accumulators allow of a large surplus of air ready for any sudden call, so that the air compressors may fill all the chambers full when little air is being used.

Besides the special compressors for the high pressure needed for the torpedoes, of which there are two, as now provided on our large ships, there are duplicate compressors and reservoirs, or accumulators, that keep up a constant pressure of 60 pounds per square inch.

This pressure is kept constant by the action of the pressure regulators of the reservoirs acting on the throttle of the compressor, and the mechanism is found efficient for all emergencies, the pressure never dropping over 5 pounds at any time, and that only when a crane and anchor engine happen to be suddenly put in use at the same instant. At such times, however, warning is given, so that the steam stop valve outside the throttle of the air compressor engine may be opened wider, to allow for the sudden addition of such great quautities of work. Signals have previously been sent to the central plant room, to open air to the pipes for these machines, as explained below. In getting under way, and at drills when the turrets are likely to be used suddenly, both of the compressors are in operation to insure greater steadiness of pressure, but ordinarily one is amply sufficient for all needs.

In easy reach of the two attendants are valves plainly marked on the air pipes leading to each machine outside of the central plant room. Each of these machines has its own pipe, so that a large machine opening from a pipe may not throw out a smaller one, as happens with the steam pipes ordinarily in use. By this means absolute uniformity of air pressure is secured for each machine, the sizes of pipes to each being calculated for the work to be done. At a signal from any part of the ship, the air is turned on and the machine is ready for use at once. The throttle valve at the machine is the only valve that the attendant in the distant part of the ship needs to touch. Having uo exhaust valve and no drains to attend to, the operator has a simple operation to perform, only oiling the machine. After use, closing the throttle valve secures the machine. No harm is done if a signal be

not sent to the central plant room when finished with the machine, so that the valve may be closed there, as a possible slight leak of air is the only trouble that can ensue. The pipe is left filled with air at the full pressure, and this air is clways ready to do its work. No vacuum is destroyed by ignorance or carelessness. No return exhaust pipe is required, one small pipe carrying the power, the exhaust being into the atmosphere. The air to be used is drawn down from the ventilators, and passes around and among pipes filled with running water, so that a portion of the moisture in the air is condensed and tapped off. There are also separators where needed for removing the moisture from the air after it is compressed. The temperature of the air may be readily varied to any degree not below that of the sea water, by reducing or increasing the quantity of the circulating water, regulating the temperature of the discharge water and of the air compressed. By opening and closing the large exhaust ventilating doors at the top of the central plant room, the air in the accumulators may be kept at the temperature of the atmosphere, or as much higher as desired.

The engines in the different parts of the ship are all of the same type, but of three different sizes, thus making parts interchangeable and doing away with the carrying of many spare parts. The pipes to these machines are also of three sizes. Where a great power is required, as for turrets or anchor engine, two of the largest sizes of machines are attached to one shaft. The machines are small, three-cylinder simple, long stroke, light and fast running, the air expanding just enough to prevent the formation of ice at the exhaust nozzles, the pressure at discharge being slightly above the atmospheric pressure. At the exhaust openings there are mufflers constructed of a non-resonant substance, thus preventing much noise. These engines are geared down for the work they have to do, thus enabling the three sizes of machines to handle all the various kinds and quantities of work to be done in the ship.

This system does away with the enormous prices paid for special machines all over the ship.

The following list shows the uses to which air is put on board:

To operate—Main engine auxiliaries; auxiliary, fire, bilge and water service dumps; steering engine; anchor engine; boat cranes; winches; turret-turning engines; hydraulic cylinders for working guns; ammunition hoists; ash hydro-pneumatic hoists; feed pumps; smoke hose for guns; whistle and siren.

Other uses: To send messages; to clear a compartment of water when flooded; to ventilate; to heat and cool the ship.

Air is better than steam for auxiliary use on board ship, for the following reasons:

The ship is cooler in summer, and men are not debilitated by the heat; there are no hot bulkheads all over the ship; the auxiliary machinery and pipes last much longer; half the number of valves, pipes, etc., are needed; there are no ventilating blowers, the heater lines doing the work; there is great saving in cost of plants and in the cost of oil; no pipe coverings are needed; the machines are ready for use at once; there are fewer men on watch in port, and more for general work; the launch is ready at any moment, at sea or in port; there is no smoke, heat, etc., and only one man is required.

It is needless to say that all the machinery is in charge of the chief engineer of the ship.

It is certain that something must be done to relieve the officers and crew of our men-of-war of the suffering from the terrible heat on these ships in summer.

—American Machinist.

A test was recently made by H. K. Porter & Co. of a compressed air locomotive for mine haulage purposes. It was made for the Anaconda Copper Mining Co. in order to demonstrate the relative merits of their locomotive.

The result was shown that though the locomotive was designed to make four round trips, it was capable of making five round trips, with plenty of surplus to provide for shifting cars at the end of each haul.

The test also proved that the same locomotive, equipped with a reheater, makes a gain in efficiency from the use of the same amount of air of from 40 to 50 per cent.

COMPRESSED AIR.

(CONTINUED.)

Several years ago experiments were made by the Westinghouse Company, extending over a period of two years, the purpose being to determine the question of steam economy. The eight-inch pump had been designed at a time when the average locomotive boiler pressure was about 120 lbs., and in order to secure an abundant supply of air the area of the steam piston was made about 15 per cent. greater than that of the air piston. Between that time and the time when the tests were begun, the steam pressure of locomotive boilers had become considerably increased, so that the greater area of the steam piston of the air-pump was no longer necessary. Experiments were conducted both with a simple pump of suitable proportions to meet the changed conditions of service, and with a compound pump, designed to attain the highest steam economy subject to the peculiar limitations of the service.

The following descriptions of these tests are given by Mr. Parke in his paper before the New York Railroad Clnb.

"The design of compound pump which seemed to best meet the requirements has two steam cylinders, respectively 6 inches and 10 inches in diameter, and each of 10 inches stroke. Live steam is admitted to the smaller or high-pressure steam cylinder throughout the entire stroke, and, upon the return stroke, it expands into the larger or low-pressure steam cylinder, no live steam being admitted to the latter. All the ports of both steam cylinders are controlled by a single steam valve. There are two air cylinders, the diameters of which are respectively 6½ inches and 9½ inches, and the stroke of each is 10 inches. Atmospheric air is drawn into the larger or low-pressure air cylinder, and compressed therefrom into the smaller or high-pressure air cylinder. In the latter, the air is further compressed and delivered thence to the main reservoir. The piston of the high-pressure steam cylinder operates that of the low-pressure air cylinder, and the piston of the low-pressure steam cylinder operates that of the high-pressure air cylinder. The reversing valve is actuated by the high-pressure steam piston. By this arrangement, the complete stroke of both the high-pressure steam piston and the low-pressure air piston is always assured, so that the pump cannot become dead, and a cylinder full of free air is always secured. The pump is operative at any steam pressure, the pressure at which the air can be delivered, depending of course, upon the available steam pressure.

The design of simple pump resulting from these experiments was what is now known as the 9½-inch pump, which has one steam and one air cylinder, each 9½ inches in diameter, with a 10-inch stroke.

In the tests of the various pumps, as to efficiency and capacity, the steam was condensed in a surface condenser, at atmospheric pressure and weighed, and the volume of air actually delivered was carefully measured. The conditions under which the tests were made were those of about the average service to be expected on the road; that is, the steam pressure used was

140 pounds and the pumps were required to deliver against an air pressure of 90 pounds.

Table VI, indicates the capacities and efficiencies of the various types of air-brake pumps under these conditions. For comparison, this table also indicates the volume of free air compressed to 90 pounds and delivered per pound of steam by a single-stage commercial compressor, operated by an efficient simple engine, and by a two-stage compressor, with intercooler, operated by a compound non-condensing engine.

Pump.	Volume of Free Air Compressed to 90 lbs. and Discharged.	
	Per Min.	Per Pound of Steam at 140 lbs. Pressure.
8-inch	26.3 cu. ft.	1.85 cu. ft.
9½-inch	44.9 "	2.49 "
Compound	43.3 "	4.89 "
5-inch Duplex	29.4 "	2.06 "
7 " "	38.7 "	2.43 "
Simple compressor, operated by simple engine	......	8.80 "
Two-stage compressor operated by compound, non-condensing engine	....	13.70 "

The most striking feature of this table is the low efficiency of an air-brake pump, in comparison with a suitable compressor for a commercial supply of compressed air. Steam generation in stationery boilers for ordinary power purposes, is comparatively uniform, and the amount of fuel burned is practically proportional to the quantity of steam used. Under such conditions, unless the volume of compressed air required is very small, or is required at irregular intervals and in uncertain quantities, it is not economy to use an air-brake pump in the place of a suitable compressor.

At the conclusion of these pump tests, it was decided to place the 9½-inch pump upon the market, and, although the design of compound pump selected proves entirely satisfactory as to capacity, and requires only one-half the steam used by any air-brake pump in the market, it was decided to abandon any thought of offering it for sale. The reasons for the latter decision were chiefly the following.

While the only working parts added to those of the simple pump are the additional pair of pistons and two additional air valves, a long experience has led to the conviction that simplification and not complication of air pump construction is what the best interests of the railroads require. The increased number of parts necessarily implies greater cost of maintenance and renewals, additional glands to be kept packed, a considerably increased number of sources of leakage, and the additional pair of cylinders materially increases the bulk and the weight of the pump. This was regarded as the most serious objection to the introduction of a double pump.

Another serious objection is heating of the air end of the pump. It has been fully explained that compounding, or compressing in stages, is the method most to be preferred, when the air is cooled between the stages. It might also have been stated that for practical reasons, compounding the air, without cooling between the stages, is the worst method. By this method the air is theoretically delivered by the high-pressure air-cylinder at about the same temperature as it is from the air cylinder of a simple compressor; but the temperature of the air taken into the cylinder of a simple compressor is that of the atmosphere, while that of the air taken into the high-pressure air cylinder of the compound method (without cooling), is from 200 to 300 degrees above that of the atmosphere. It is evident, therefore, that the mean temperature of the air in the high-pressure air cylinder of the compound method, is very much higher than that of the air in a simple compressor. Indeed, it several times occured, during the experiments referred to, that when a pump of the two air-cylinder type was allowed to run freely

for twenty-five or thirty minutes, under the conditions stated, the maple plank upon the brick wall of the testing room to which the air cylinders were bolted, took fire. Such high temperatures of the high-pressure air cylinder are productive of serious evils. The two air cylinders are necessarily cast in one piece, of an irregular shape, and expansion by heat is inevitably accompanied by distortion. This distortion at the air cylinders is aggravated by the still further increased temperature resulting from binding of the pistons. Unless the air pistons are originally fitted so loosely as to permit them to leak badly, they bind and cut, causing great wear and materially increasing the cost of maintenance. The distortion of the air cylinders always causes a large amount of leakage past the pistons, and the actual efficiency of such pumps is far below that calculated for them. As it is wholly impracticable to introduce a cooling chamber upon a locomotive, in connection with the compound air cylinders, this type of pump seems to be very undesirable.

The one other important reason for abandoning the compound pump is that steam economy in an air-brake pump is not of importance or value. Such a conclusion may at first cause some surprise, but a little study of the conditions will fully support it. The steam requirements of a locomotive are very difficult ones to meet, as the demand for steam to operate the engine fluctuates very greatly. The steam required by an air-break pump is not only an exceedingly small proportion of the quantity generated, but it also fluctuates between limits widely apart. The air-brake pump does its heaviest duty while standing at stations and in descending grades.

At such times the engines of the locomotive use no steam, and such steam as is then used by the air-brake pump would otherwise probably escape through the pop valve. It is well known that, with the most careful firing, it is practically impossible to prevent a waste of steam through the safety valve at such times."

W. L. SAUNDERS.

Mr. Chas. G. Eckstein, of Chas. G. Eckstein & Co., will sail for Europe in the first part of June to establish offices in Berlin, Dortmund, and Leipsic, to introduce all kinds of special air appliances of American manufacture.

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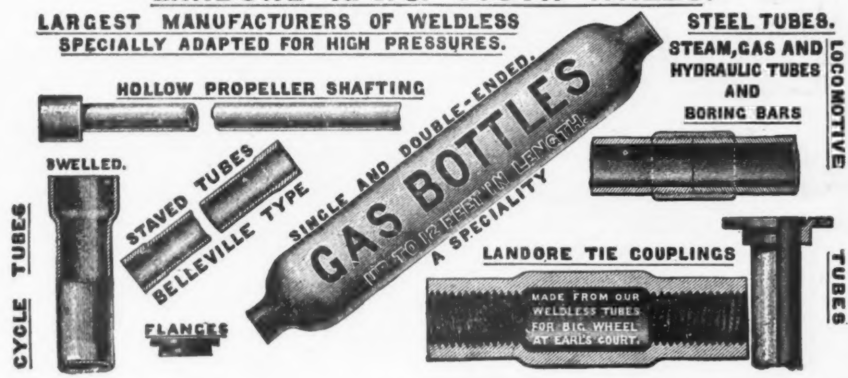

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